INTRAOCULAR LENS

BACKGROUND OF THE INVENTION

In cataract surgery, following either intracapsular or extracapsular extraction of the cataractous lens, an intraocular lens may be implanted. Various types of such lenses have been proposed. They may be implanted in the anterior chamber, the posterior chamber, or in the pupilary space. In anterior chamber placement, the lens is fixed, anchored or supported in the angle at the intersection of the cornea and the iris. Although the anterior chamber is the most readily accessible for such lens implantation, unless the lens is carefully sized or fitted to precisely be supported across the angle, it may traumatize the cornea, or angle structures. A pupilary space lens is supported by the iris, and commonly is secured directly to the iris. Although such a lens is centered in the pupil or pupilary space, the support may be poor and the iris may not be dilated when desired. The posterior chamber may be considered to be most advantageous for intraocular lens implantation because of the original lens being located in that chamber. However, it is the most difficult and least accessible area for such implantation and fixation, expecially following intracapsular extraction.

SUMMARY OF THE INVENTION

It is to the elimination of the aforesaid problems that the intraocular lens of the present invention is directed. The lens incorporates a plurality of non-biodegradable strands which are fixed to the lens body, and which strands are composed of a material which is flexible and yet has specific spring-like memory qualities whereby the strands may be substantially fully compressed or offset from the normal rest position and thereafter returned to the fully extended condition when pressure is removed. Such a feature is achieved by securing only one strand to the lens with the opposite end being unsecured. The lens is readily inserted into the posterior chamber and fixed on the ciliary body or muscle and automatically centered with respect to the pupil. These features of the lens as well as its implantation will be more fully explained in the following detailed disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevational view of the intraocular lens of the invention;

FIG. **2** is a side elevational view thereof;

FIG. **3** is a front elevational view of the lens of FIG. **1** illustrating support strand compression;

FIG. **4** is a cross-section schematic of the human eye illustrating posterior chamber implantation of the lens of FIG. **1**;

FIGS. **5–7** illustrate the stages of posterior chamber implantation of the lens of the invention;

FIG. **8** illustrates an alternative lens support strand shape;

FIG. **9** illustrates a three strand embodiment of the lens of the invention; and

FIG. **10** shows a unitary ring and strand member in which the lens is held.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. **1** is shown the intraocular lens **10** of the invention having a lens body **12** and a pair of strands **14** and **16**, which strands support the lens body when it has been implanted. The lens body **12** may be produced from any suitable material, preferably a plastic which is non-degradable and non-toxic in the eye. A preferred composition for the lens body comprises an acrylic resin which has been manufactured to a desired prescription and which has a desirable shape. The most preferred lens body composition comprises polymethyl methacrylate, and preferably an ophthalmic grade polymer having a very low free or residual monomer.

A preferred shape of the lens body is illustrated in FIGS. **1** and **2**, in which the anterior lens body surface **30** is convex while the posterior surface **28** is flat or planar. The lens body peripheral edge **26** is shown to be circular which is the preferred lens shape, although any other desirable lens body surface and edge shapes may be used, and those shown are by way of illustration only.

Once implanted, the lens body is supported and held in place by a plurality of support strands. In the preferred embodiment shown, two of such strands **14** and **16** are used, each one being attached or secured adjacent to the peripheral lens body edge and on opposite sides thereof. These strands must be flexible, that is they must be yielding under pressure, but must also have a memory retaining feature whereby the strand will return to its normal extended position or will automatically tend to do so once the pressure has been released. Thus, the strands must have a spring-like quality as will be further explained hereinafter.

The strands are attached to the lens body by any convenient or desirable means. Especially useful is means for securing the strands to the lens body adjacent the peripheral lens body edge so as to have minimum interference with the lens body itself. This is conveniently achieved by providing bored, drilled or molded shafts **21** and **23** along the sides of the lens body and inserting one end of each of the strands into a shaft. The inserted strand end may then be secured by adhesive or other mechanical means. However, an especially convenient means for securing the strand end comprises providing an orifice **25** and **27** through the lens body and across each shaft **21** and **23** respectively. In other words, each orifice intersects a shaft conveniently at an angle approximately normal to the elongated shaft axis. When one end has been inserted into a shaft and is exposed to the orifice, a heated plunger or needle is placed in the orifice thereby melting the strand end whereby an enlarged end portion is formed which has a size greater than the cross-section of the shaft. This will prevent the strand from being removed or pulled from the shaft. Alternatively, both the strand end and acrylic material within the orifice may become molten thereby uniting to provide an extensive bond therebetween to prevent removal of the strand. Again, however, any convenient means such as adhesive or the like may be used to so secure the strand.

Observing further the strands **14** and **16** of FIGS. **1–3**, each one has a substantially straight leg or portion **32** extending away from the lens body, and a curved or arched portion **36**, terminating in an end **22**. The purpose for the arched portion is to present a rounded strand surface for being urged against or abutting the ciliary body or muscle when the lens is implanted in the posterior chamber. Further, end **22** of the strand is directed back toward the lens body as shown. This feature is intended to prevent the strand end from being pointed or jabbed against the delicate tissue within the